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its wake created a number of corollary industries. Even the very agriculture of cotton has been deeply influenced in several ways. The knotty problem for it to solve now are the questions of handloom weavers and modernisation. In the latter, the industry has to reorient its views completely. It has to recognise the place of fundamental research in the progress of any real industry. At present there are only a few Government sponsored institutes for research and institutes for training in textile branches. It is very necessary that the industry should set up endowments for conducting fundamental researches in all branches of textile science and sponsor on its own institutes and research centres in all important places. What more, it should be the minimum requirement for all mills etc. to maintain research laboratories themselves to solve their immediate problems. We hope that the industry will emerge at no distant date fully modernised and once more place India as the foremost textile producer of the world.

Our New Patron: We welcome with great pleasure Shri K. P. Amrithanatha Iyer of Monkompu, Travancore Cochin State as a patron of the Madras Agricultural Union. He has been for long a subscriber to this Journal. Shri Iyer is a keen and practical agriculturist dealing with a variety of crops such as paddy, coconut, tea, rubber, pepper, arecanut, etc. He has been actively concerned with many nation building agricultural and co-operative organizations. He was a member of the Food and Grains Committee, I. C. A. R. New Delhi and also of the Irrigation Committee. He is now a member of the Food and Advisory Board, the District Development Committee, the Central Milk Board, Project Advisory Board—Kuttanad, Community Project Travancore-Cochin State and is also the president of the Milk Union and Taluk Co-operative Union Allepy, T. C. He was awarded a prize in the District Paddy Growing Competition. His deep interest in promoting scientific agriculture is further evinced in his offer to co-operate in all possible ways in conducting trials in his fields at his *own risk and expenditure.* Indian Agriculture needs many more such broadminded agriculturists.

A Note on the Technique of "Ranking" in Plant Breeding

by

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Very often plant breeders face the difficulty of placing various types or cultures in order of merit for one or more of their attributes. Cotton varieties, for example might be ranked for their vigour, squaring or disease resistance into definite groups as better than, equal to or poorer than the standard (the local strain cultivated). New varieties under trial for the first time might be ranked in order of merit without assigning any numerical measure of intrinsic worth to each type. Ranking arises naturally in cases where for lack of time, money or instruments, measurement of a characteristic is considered impossible. It is not possible for a cotton breeder, for example, to count the number of bolls or squares of every type particularly when he deals with large collection of material. He can only rank these types into certain definite groups. We are sometimes forced to have recourse to ranking methods even when measurements have been made, in order to reduce the labour of computation or to get an idea of the general trend.

Spearman's rank correlation coefficient is the best known technique in this field. Suppose we have ten cotton types ranked for red-leaf resistance in order of merit by designating the decreasing grades of resistance as 1 to 10 by two observers. Let us also suppose that when the ten varieties are denoted by the letters A, B, C, ... J and the two observers as X and Y, the following ranking results are obtained.

Varieties	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
Ranked by observer X	2	1	3	4	6	5	8	7	10	9
Ranked by observer Y	3	2	1	4	6	7	5	9	10	8
Rank difference (Y—X) = d	1	1	-2	0	0	2	-3	2	0	-1
Sq. of difference = d^2	1	1	4	0	0	4	9	4	0	1

The problem is to find whether the two observers show evidence of agreement in regard to ranking. This is solved by Spearman's rank correlation co-efficient which is denoted by

$$R = 1 - \frac{6 \Sigma d^2}{n^3 - n}$$

Where Σd^2 is the sum of squares of rank differences, and 'n' is the number of types ranked. In the above example Σd^2 is 24 with 'n' equal to 10, so that the correlation co-efficient is

$$R = 1 - \frac{6 \times 24}{1000 - 10} = 0{\cdot}85.$$

The rank correlation co-efficient has been so designed that the value will be plus 1 when the rankings are indentical and minus 1 when they are at their maximum disagreement. In the case of the example, the observers X and Y show a fair agreement between each other in their ranking of the varieties for their resistance to red leaf disease. But there is every possibility that the measure of agreement may have arisen by chance. In order to test it, we have to work out the significance of rank correlation co-efficient. If 'n', (the number of items ranked) is not less than 10, we may calculate Students 't' as $R\sqrt{\frac{n-2}{1-R^2}}$ with n—2 degrees of freedom. Making the necessary substitution in the formula we find

$$\text{Students} \quad t = 0{\cdot}85\sqrt{\frac{10-2}{1-85^2}} = 4{\cdot}55.$$

The value of 't' from table (P=0·01%) with 8 degrees of freedom is 3·355. As our value is higher than this, we conclude that the degree of agreement between the two observers is significant.

There is every possibility here that both the observers may be wrong in their rankings even though they may both agree. To test whether an individual is a good judge, we can use the same Spearman's rank correlation co-efficient. Suppose there are ten types of cotton, the number of squares produced by them are actually counted, the types are ranked by observer, the capacity of the observer is to be judged and the ranking recorded by him is as follows :

		A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
True rank by actual counting		1	2	3	4	5	6	7	8	9	10
Rank given by the observer		3	2	4	1	7	5	10	6	9	8
d	=	2	0	1	-3	2	-1	3	-2	0	-2
d^2	=	4	0	1	9	4	1	9	4	0	4

which gives $\Sigma d^2 = 36$ with n = 10.

$$R = 1 - \frac{6\ \Sigma d^2}{n^3 - n} = 1 - \frac{216}{990} = 0{\cdot}78$$

from which we can calculate.

$$\text{Students 't'} = R\sqrt{\frac{n-2}{1-R^2}} = 0{\cdot}78\sqrt{\frac{10-2}{1-0{\cdot}78^2}} = 3{\cdot}5.$$

The 1% level of Students 't' with n—2 = 8 degrees of freedom is 3·36. We therefore conclude that the observer's ranking correlates significantly with the true ranking.

Spearman's rank correlation co-efficient is thus a very useful technique in finding out (a) whether two independent observers show significant agreement between them in ranking a set of types and (b) whether an experimentalist is proficient enough to judge the various types by ranking them without any actual measurement.

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Some Studies of 2, 4-D Toxicity in Soils in Herbicidal Concentrations

by

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It has been pointed out by many investigators in several instances that 2, 4-Dichlorophenoxy acetic acid, applied in herbicidal concentrations leaves toxic effects in the soils. Attempts have been made by workers to assess the persistence of its toxicity and in almost all these studies the emergence of certain seedling like tomato, cucumber and beans have been used as criteria. Nutman et al (1945) reported that 2, 4-D when applied in small quantities of herebicidal concentrations had some toxic effect on soil but it disappeared in a course of 36 days. Mitchell and Marth (1948) found soils kept in dry conditions were toxic even at the end of 18 months. De Rose (1946) Taylor (1947) and Kries (1947) all noted that 2, 4-D persists in soils and supresses germination and growth of plants. Brown and

Mitchell (1948), Carlson and Hamner (1948), Hernandez and Warren (1948), Akamine (1951) have shown that the inactivation of 2, 4-D was greatly influenced by factors like temperature, soil moisture, pH, soil type, organic matter, autoclaving, rainfall, and other environmental factors.

While all this work relates to temperate conditions of climate and soils, very little work has been done under tropical conditions in India. Some experiments were therefore conducted under regulated conditions in laboratory, in the Department of Agriculture, Annamalai University, using two types of soils showing two different pH values to study the toxic effects of 2, 4-D in the soils in a preliminary way.

Materials and Methods: The germination and growth of Indian flat beans *(Dolichos lablab)* sown at 2 week-intervals in treated and non-treated flats were used as critera for assessing the persistence of 2, 4-D toxicity in soils. Two types of soils, clayey and sandy loam with pH values of 7·8 and 6·5 respectively, were used in the experiment. Wooden flats of 18"x12"x9" were filled with the soil to a depth of 6". 2, 4-D was applied in pure acid form as a surface dust calculated at 2 lb. per acre. Fifty bean seeds were sown in each flat and at the end of 2 weeks, the extent of germination and number of normal and abnormal seedlings in treated flats were noted and the results compared with the control. These seedlings were pulled out and another sowing was made immediately. Cropping was thus continued until the germination and growth of seedlings in treated flats when expressed as a percentage of control was 95%, it was assumed that the toxicity was lost. For each type of soil two flats were treated and two flats were non-treated. The factor of leaching was prevented by allowing water in quantities just sufficient for germination and growth of plants. To be sure that the chemical had not been reached to the bottom, at the conclusion of the experiment the soil in the flats was inverted and bean seeds were sown and the germination and growth of seedlings observed.

Results: 2, 4-D showed toxic effects in sandy soils upto 8 weeks and in clayey soils upto 6 weeks. The toxicity was lost two weeks earlier in clayey soils. Irrespective of soils germinating bean seeds and seedlings exhibited various pattern of abnormalities in treated flats. The chief modifications were formation of swollen hypocotyl loop in certain seeds, reversion in germination, formation of an irregularly thickened cancerous growth at base of stems from which roots were given off, and alteration of size, shape, texture and

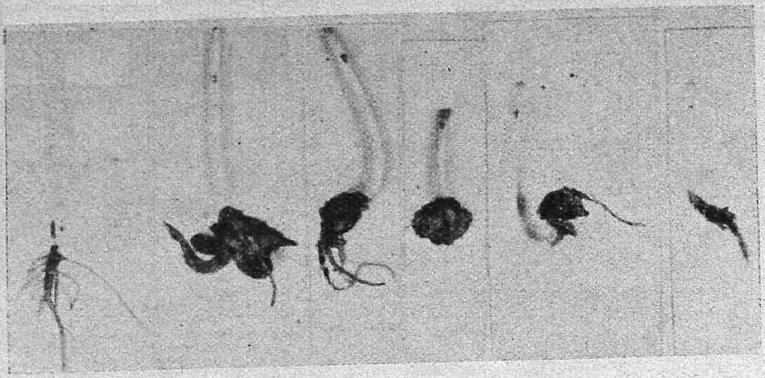

Fig. 1.

Cancerous growths at the base of stems of bean seedlings induced by 2, 4-D. Left extreme: Control.

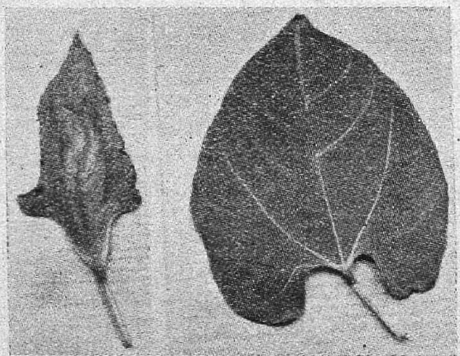

Fig. 2.

Alteration in shape, size and venation of bean leaves induced by 2, 4-D. Left: Treated. Right: Control.

venation of leaves in many cases. Fig. 1 shows the cancerous growth at the base of stems, and Fig. 2 the alteration of size, shape and venation of leaves. Table I shows the normal bean seedlings expressed as percentage of control until the toxicity was lost in both soils. Data were also collected with regard to the emergence of abnormal seeds and seedlings in flats treated with 2, 4-D at 2 weeks intervals in both soils until toxicity was lost and it is shown in Table II. The perusal of the data in Table I will indicate that there was a complete failure of emergence of normal seedlings for the first 4 weeks in flats treated with 2, 4-D irrespective of the soil types. It was interesting to note that while in sandy soils the emergence of normal seedlings gradually increased from the 4th to 8th week, it was rather abrupt in clayey soils. By the end of 4 weeks, there was sudden emergence of normal seedlings almost equalling the control in clayey soils.

TABLE I.

Percentage of emergence of normal bean seedlings at two week intervals in sandy and clayey soils treated with 2, 4-D.

	Sandy Soils			Clayey		
	Counts regarding emergence of normal seedlings					
Interval between treatment of 2, 4-D and sowing seeds (in weeks)	Treated	Non-treated	Normal seedlings expressed as % of control	Treated	Non-treated	Normal seedlings expressed as % of control
1·0	Nil	77	Nil	Nil	95	Nil
2·2	Nil	70	Nil	Nil	96	Nil
3·4	17	75	22·67	77	84	91·67
4·6	89	95	93·68	87	88	98·86
5·8	94	95	98·95	..	..	..

TABLE II

Abnormal seeds and seedlings expressed as a percentage of control at two week intervals in sandy soils and clayey soils treated with 2, 4-D

	Sandy soil		Clayey soil	
	Interval between application of 2, 4-D and sowing of bean seeds (in weeks)	Abnormal seeds and seedlings	Interval between application of 2, 4-D and sowing of bean seeds (in weeks)	Abnormal seedlings
1.	0	85·74	0	91 89
2.	2	80·00	2	75·00
3.	4	46·66	4	5·71
4.	6	5·26	6	Nil
5.	8	Nil	..	..

Discussion: In the results obtained with our experiments it is seen that sandy soil with 6·5 pH has retained toxicity for a longer time than the clayey soil with a pH value of 7·8. In these experiments except the variation in soil type and pH, every other factor of environment, like temperature, moisture etc. was the same for the different treatments. Akamine (1951) working in soils reported that soils high in pH value inactivated 2,4-D more rapidly than those low in pH value. In our experiments also soils with a higher pH value has shown inactivation nearly 2 weeks earlier than the soils lower in pH value. Thus our results are in consonance with those of Akamine. In general it is further noted that abnormal *seeds and seedlings* were altogether greater in sandy soils than in clayey, although during the first sowing, the abnormal seedlings were somewhat higher in clayey soils. Further, the sandy soil in the case of our experiment has shown longer period of retention of 2,4-D than clayey soils. These suggest that 2,4-D is more toxic in sandy soils than clayey one. *Nutman et al (1945) in attempting to* find out the toxic effects of 2,4-D in different soil types report that in Rothamsted soil, a clayey one, 2,4-D had less marked effect than in Wouburn soil, a sandy one. It was also interesting to note in our experiments that while emergence of normal seedlings was gradual in sandy soil, it was rather abrupt in clayey soil. Modifications exhibited by bean seeds, and seedlings were similar to those described by Zimmerman and Hitchcock (1942), De Rose (1946) and Kries (1947).

It should be noted that the experiments were conducted under conditions where leaching was not permitted. When conducted under field conditions, the amount of rainfall in a place is also likely to influence the inactivation of 2,4-D and this has been pointed out by De Rose (1946).

Summary and Conclusions: 2,4-D was applied as surface dust in two types of soils with pH values 6·5 and 7·8 respectively at calculated rate of 2 lb. per acre. The germination and growth of bean plants were used as criteria for assessing toxicity of 2,4-D in herbicidal concentrations. The results within the limitations of the experiments indicate that soil type and pH considerably affect the inactivation of 2,4-D in herbicidal concentrations. Soils with high pH value inactivated the herbicide earlier than the soil with a lower pH value. The germination of bean seeds irrespective of soil types exhibited various patterns of abnormalities characteristic of the compound 2,4-D. It was also noted that there was total failure of

emergence of normal seedlings in soils treated with 2,4-D for the first 4 weeks but thereafter the emergence of normal seedlings was gradual in sandy soils while it was abrupt in clayey soils.

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Removal of High Acidity in Ghee

by

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Introduction: It was described in a note by the Bureau of Public Information, Government of India, that a simple process for the removal of free-fatty-acids in ghee had been worked out under the auspicies of the I. C. A. R. The method was acclaimed to be simple, involving no new or extra equipment from those used in ghee making. The loss of ghee due to removal of the acid fraction and during the processing was said to be small. The resultant product was said to be wholesome which would fetch a better price than the original high acid ghee. In order to test the method suggested in the note, experiments were conducted for the removal of high acidity in ghee. Sambasiva Rao (1949) studied several methods suitable for adoption by the housewife for preparing good ghee from butter and found that preservation under butter milk was the best He also describes a method for renovation of bad smelling rancid ghee, by boiling it with banana slices. This treatment seems to have given a ghee passable in flavour and taste.

Materials and Methods: The ghee samples were prepared as follows: Ghee was melted at about 70°C. when powdered lime of good quality was sprinkled on it at the rate of 3 per cent of the total quantity of ghee taken. The mixture was then well stirred and heated rapidly to 102°C. It was then filtered by passing it through a filter cloth over a funnel.

Two sets of treatments were made on ghee and coconut oil, one in the laboratory of the Government Agricultural Chemist and the other in the College Dairy as per details given below:

Treatments.

(A) Treated in the College Dairy:

Nature of sample	Treatments
1. Good quality ghee prepared in the College Dairy, from buffalo butter	Not treated (control 1)
2. Poor quality ghee (purchased)	,, (,, 2)
3. Poor quality ghee (same as 2)	Plus 3% CaO pure
4. Poor quality ghee (same as 2)	Plus 3% local lime (impure)
5. Poor quality ghee (same as 2) blended with 25% good quality ghee (sample No. 1)	Plus 3% local lime (impure)
6. Coconut oil	Not treated (control)
7. Coconut oil (Same as 6)	Plus 3% local lime (impure)

(B) Treated in the Laboratory :

	Nature of sample	Treatments
1 (a)	Good quality ghee prepared in the laboratory from butter obtained from the Coimbatore Co-operative Milk Supply Union	Not treated (control 1)
2 (a)	Poor quality ghee purchased	Not treated (control 2)
3 (a)	Poor quality ghee (sample No. 2 a)	Plus 3% CaO pure
4 (a)	Poor quality ghee (sample No. 2 a) blended with 50% good quality ghee (sample No. 1 a)	Plus 3% CaO pure
5 (a)	Coconut oil	Not treated (control)
6 (a)	Coconut oil (same as sample No. 5 a)	Plus 3% CaO pure

Each set was divided into two thus making four lots. Two lots, one of each set, were preserved in the College Dairy for observation by the Dairy Manager for flavour, aroma, body texture, colour and feel. The other two lots were preserved in the laboratory and were analysed thrice, (1) immediately after treatment; (2) three months after and (3) eight months after treatment for acidity and rancidity. Throughout the period of storage the samples were kept shut off from light but had access to air, as the mouth of the bottles were kept covered with muslin cloth. Frying tests were also carried out with the samples at the end.

Methods of Analysis: Acid value was determined by the standard method given in A. O. A. C. Rancidity was determined by Issoglios' method which consists in distilling in a current of steam a weighed quantity of oil or fat mixed with a measured quantity of water and titrating the distillate with N/100 potassium permanganate solution.

Experimental Results: The results of the experiments are presented in Tables I and II.

Discussion: Since the acid value is a measure of free fatty acids present in the sample and does not always run parallel with the production of rancidity and the determination of acid value may not always indicate the fact that a sample is not sound, rancidity was estimated in the samples by means of the "oxidisability value" i. e. the amount of oxygen consumed under standard conditions by the aldehydes and other products of rancidity after distillation in a current of steam.

It is seen from the data presented in the tables, that there is considerable difference between the two sets, the one treated in the laboratory and the other in the College Dairy. Both acidity and rancidity increase progressively with time in the case of samples treated in the laboratory, whereas there is a definite decrease in rancidity values in the second round with very slow increase in acidity in the case of those treated in the Dairy. It was ascertained from the Dairy that the samples were filtered through muslin after lime treatment which permitted a considerable portion of lime to pass through and remain at the bottom of the samples. On the other hand the laboratory samples were filtered through Whatman's No. 3 filter paper which allowed no lime to pass through. The presence of excess of free lime in Dairy samples was confirmed at the end of the eighth month by qualitative tests, wereas no free lime was found in the laboratory samples. No doubt the presence of free lime was responsible for differences in the data obtained in the analyses of the two samples since the acids produced in ghee and oil would combine with the free lime very slowly at room temperature and this is the reason for the differences in the values.

As regards the samples prepared in this laboratory, it is seen that liming has definitly retarded the development of acidity even upto eight months but it has not retarded the increase of rancidity in both ghee and oil samples as indicated by the results obtained in the third round of analysis.

It was seen that in spite of favourable analytical indications, especially in point of acidity, the treated as well as untreated samples have all become definitely bad and unfit for consumption in point of taste and aroma. When heated they all emitted a very objectionable odour. The treated samples had in addition acquired a pronounced limey taste and flavour even from the very beginning.

It may be stated that while the treatment of ghee with lime retards the development of acidity upto eight months and rancidity upto three months; the treatment does not improve the product in point of taste and aroma. In the case of coconut oil the treatment could be said to have improved the initial samples, besides slowing down the rate of deterioration and thereby increasing the marketable period. The lime treatment resulted in a smoking ghee, which gave a burnt taste to fried things.

Summary: The treatments with chemically pure as well as local quicklime improved the colour, but the flavour and aroma were

almost completely lost in samples prepared at the Dairy, though an improvement in flavour and aroma was noticed in the samples prepared in the laboratory. In both the samples the smell of lime was persistant.

In both the above sets in the treated samples no perceptible deterioration occurred during the first two months of storage whereas the untreated control as well as the standard good quality ghee deteriorated all round.

The deterioration was more rapid at the end of three months, the rate being faster in the bazaar ghee used as control. The rate of deterioration and the final product in the case of quality ghee compare favourably with all the treated samples and is in no way inferior.

The treatment with lime tended to produce smoking ghee giving a burnt taste to fried things.

The treatment of ghee with lime did not improve the quality of ghee, in point of taste and aroma.

Acknowledgments: Thanks are due to Sri H. Shiva Rao, Government Agricultural Chemist (Retired) for his interest in the study and to late P. D. Karunakar, the then Agricultural Bacteriologist, for initiating the investigation. Our thanks are also due to Sri A. K. Annaswami Iyer, then Dairy Manager, for his help and collaboration in this study.

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STATEMENT I

Removal of High Acidity in Ghee and Coconut Oil—Observations on Samples Prepared at the Diary

	SAMPLES							
	I	II	III	IV	V	VI	VII	
	Good quality ghee	Poor quality bazaar ghee	Poor quality ghee treated with 3% CaO pure	Poor quality ghee treated with local lime	Poor quality plus 50% good ghee treated with 3% lime	Coconut oil bazaar sample	Same as VI treated with 3% lime	Remarks
At commencement	Good	Poor	Colour and taste good	Slightly inferior to sample III	Same as sample IV	Good flavour and taste	Slightly better than sample VI	
Third month	Rapid loss of quality	Rapid deterioration	Rapid deteriora- except colour	Very rapid deterioration set in. Loss in taste	Very rapid deterioration. Taste bad	Very rapid deterioration. Bad taste	Rapid loss in flavour, aroma and taste	Deterioration set in
Eighth month	Very rapid loss in taste, body and aroama. Alcoholic taste	Badly deteriorated. Very bad smell	Rapid fall in taste, flavour and aroma bad	Gradual deterioration Rancid smell	Rapid deterioration. Very bad flavour and aroma	Badly deteriorated. Very bad rancid smell	Not so rapid loss. Moderate all round	Fall in quality
Frying quality	Good frying ghee. Non-smoking. Taste good	Good frying non-smoking but fried stuff bad smell	Slightly smoking ghee. Non-charring	Ghee smoking, charring and burnt taste	Ghee smoking, charring and burnt taste	Frying slow. Good white non-charred stuff obtained. Taste poor	Good frying Taste better than sample VI	Not good for domestic use

TABLE I

Showing the Development of Acidity and Rancidity in the Samples of Ghee and Coconut Oil After Treatment in Laboratory Samples

No.	Nature of Sample	Treatment	First Round		Second Round		Third Round	
			(a)	(b)	(a)	(b)	(a)	(b)
1 a.	Good quality ghee prepared in the laboratory from butter obtained from the Co-operative Milk Supply Union ..	Not treated	0·423	3·2	0·606	2·4	0·747	4·0
2 a.	Poor quality ghee (purchased) ..	Not treated	0·959	2·8	1·440	6·4	1·847	9·6
3 a.	Poor quality ghee (sample 2a) ..	Plus 3% CaO pure	0·014	3·2	0·127	3·2	0·367	15·2
4 a.	Poor quality ghee (sample 2a) blended with 50% good quality ghee (sample 1a) ..	Plus 3% CaO pure	0·014	2·4	0·042	4·4	0·169	8·4
5 a.	Coconut oil ..	Not treated	1·311	6·0	2·143	1·6	2·509	4·0
6 a.	Coconut oil ..	Plus 3% CaO pure	0·606	4·0	0·888	0·8	1·255	18·4

Note: (a) Acidity Oleic acid %; (b) Rancidity Mgm. Oxygen.

TABLE II

Showing the Development of Acidity and Rancidity in Ghee and Coconut Oil After Treatment in Dairy Sample

No.	Nature of Sample	Treatment	First Round		Second Round		Third Round	
			Acidity as Oleic acid %	Rancidity Mgm. Oxygen	Acidity Oleic acid %	Rancidity Mgm. Oxygen	Acidity Oleic acid %	Rancidity Mgm. oxygen
1.	Good quality ghee prepared in Dairy from buffalo butter ..	Not treated	0·367	6·0	0·409	2·0	0·564	3·6
2.	Poor quality ghee (purchased) ..	Not treated	1·213	3·6	1·255	1·0	1·480	5·2
3.	Poor quality ghee (sample 2) ..	Plus 3% pure CaO	0·042	4·4	0·085	2·4	0·113	8·0
4.	Poor quality ghee (sample 2) ..	Plus 3% local lime	0·085	5·6	0·141	1·6	0·141	6·8
5.	Poor quality ghee (sample 2) blended with 25% good quality ghee (sample 1) ..	Plus 3% local lime	0·014	2·4	0·141	0·8	0·169	4·0
6.	Coconut oil ..	Not treated	2·130	4·8	2·214	3·2	2·721	3·6
7.	Coconut oil ..	Plus 3% local lime	0·522	5·6	0·254	3·2	0·268	12·4

Use of Antibiotics in Plant Disease Control — A Review

by

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Introduction: Ever since Alexander Fleming reported on the bacteriostatic and bactericidal activity of *Penicillium notatum* in the year 1929, the study of antibiosis and antibiotic substances has advanced to a great extent and more than one hundred antibiotics have so far been isolated from various micro-organisms. Waksman (1947) clarified the confusion regarding the use of the word 'antibiotic' and defined it as, '*a chemical substance, produced by micro-organisms, which has the capacity to inhibit the growth of and even to destroy bacteria and other micro organisms*'. Most of the antibiotics isolated were tested for their use in medical science and a few of them like Penicillin, Streptomycin, Aureomycin and Terramycin have come into extensive use as chemotherapeutic agents. The use of antibiotic substances in agriculture, especially against plant diseases, is being worked out in different countries and some encouraging results have been reported.

Use against plant diseases: The possible uses of antibiotic substances in plant disease control, as understood at present, are briefly reviewed below:

(i) Control of soil-borne fungal pathogens is one of the serious problems confronting plant pathologists throughout the world and earlier workers have attempted to make use of the phenomenon of antibiosis in checking soil-borne diseases. As early as 1908 Potter stated that *Pseudomonas destructans*, the cause of rot of turnips, could be controlled by spraying a toxin produced by the bacterium in an artificial medium. Sanford and Broadfoot (1931) observed that the pathogenicity of *Ophiobolus graminis*, causing the "take-all" disease of wheat, could be checked by the culture filtrates of *Actinomyces* sp. and *Penicillium* sp. Tims (1931) obtained a certain amount of reduction in the infection of sugarcane by *Pythium arrhenomanes* when the soil was inoculated with some actinomycetes. Russian investigators (Chudiakov 1935, Novogrudsky 1936, Berezova 1939, Nanmova 1939) have suggested 'bacterization' as a means of protection against plant pathogenic fungi. The susceptibility of the seedlings to infection was stated to be reduced

by treating the seeds with specific bacteria before sowing. Anwar (1949) was able to check the incidence of flax wilt caused by *Helminthosporium sativum* by adding metabolic products of certain soil micro-organisms. Unfortunately the studies made in recent years have shown that most of the antibiotics when added to the soil lose their activity for various reasons, thus making it unreliable to apply antibiotics to the soil for controlling plant pathogens. Intensive research is going on in leading laboratories of the world to overcome this defect and the recent publication of Wright (1952), stating that *Trichoderma viride* is capable of producing Gliotoxin in non-sterile but acid soil to which one per cent clover was added, is somewhat encouraging.

(ii) Solutions of antibiotics can be sprayed on plants as a preventive measure against air-borne diseases. Vander Laan (1947) found that Clavacin, an antibiotic produced by *Aspergillus clavatus*, could be sprayed on plants to prevent fungal infection. Felber and Hamner (1948) reported that the antibiotic Actidione, isolated from *Streptomyces griseus*, when sprayed on Red Kidney beans against *Erysiphe polygoni*, the mildew completely disappeared after 48 hours. Peterson and Cation (1950) and McClure (1952) could successfully eradicate *Coccomyces hiemalis* causing leaf spot of cherry by spraying Actidione. Gregory *et al* (1952) were able to control damping-off of alfalfa seedlings by spraying Actidione. Leben and Keitt (1952) found that Helixin, an antibiotic produced by *Streptomyces* sp., was effective in controlling early blight of tomato when sprayed at a concentration of 6·5 mgm./ml. Murneck (1952) found that spraying Thiolutin, an antibiotic from *Streptomyces albus*, reduced infection by *Erwinio carotovora*, the fire blight organism affecting fruit trees.

(iii) Antibiotics can be fed to plants through roots or through leaves so that they may act as systemic fungicides and prevent infection of the plants by fungi and bacteria. Repert and Hawas (1951) demonstrated the inhibitory action of Penitalin isolated from *Penicillium italicum*, on the development of galls in fruit trees due to *Bacterium tumefaciens*. Blanchard (1951) found that galls caused by *B. tumefaciens* on tomato plants were very few when the plants were grown in a solution of Aureomycin. Brian *et al* (1951) have demonstrated that Griseofulvin, an antibiotic obtained from *Penicillium nigrum*, acted as a systemic fungicide and prevented infection by *Botrytis cinerea* on lettuce and *Alternaria solani* on tomato. Brian (1952) reported that Gliotoxin, another

antibiotic obtained from *Trichoderma virede*, acted as a systemic fungicide in tomato plants and checked infection by *A. solani.* Gopalakrishnan and Jump (1952) found evidence for the systemic activity of Thiolutin in tomato plants against infection by *Fusarium oxysporum* var. *lycopersici*. The author in his studies with a new antibiotic produced by *Bacillus subtilis* found that it acted systemically in tomato plants when fed through roots and checked infection of the leaves by *A. solani.*

(iv) Internally and externally seed-borne diseases can be easily controlled by soaking the seed material in antibiotic solutions which can diffuse through the tissues and kill the pathogen. Timonin (1946) reported complete inhibition of germination of spores of *Ustilago tritici*, the fungus causing loose smut of wheat, in Patulin solution and claimed that diffusion of the antibiotic took place in wheat seeds. Wallen and Skolko (1950) found that internal infection of pea seeds, affected with *Ascochyta pisi* was effectively controlled by antibiotic XG, isolated from *Bacillus subtilis.*

(v) So far no satisfactory remedial method has been found out for the virus diseases of plants. In recent years some of the plant viruses are reported to be inhibited by antibiotic preparations and so with the advance of our knowledge and experience with antibiotics we may be able to control some of the serious virus diseases of plants. Ramon *et al* (1948) found that an antibiotic preparation obtained from *B. subtilis* exerted a marked neutralising action on tobacco necrosis virus. Gupta and Price (1952) have shown that the growth products of *Trichothecium roseum* exhibited an inhibitory action on plant viruses, which was demonstrated to be due to change in the host susceptibility rather than action *in vitro.* Leben and Fulton (1952) reported that the antibiotic Streptomycin inactivated tobacco necrosis virus *in vitro* and Terramycin prevented multiplication of tobacco mosaic virus. Stassel *et al* (1953) found that Toximycin, obtained from *B. subtilis*, inactivated tobacco mosaic virus *in vitro.* The author in his studies also found that, infection by the viruses of *Petunia* mosaic, Chilli mosaic and *Vinca rosea* mosaic was inhibited by an antibiotic isolated from *B. subtilis.* The inhibition was found to be due to direct action of the antibiotic on the virus *in vitro* rather than any change brought about on the host tissue. These results clearly show that by using antibiotics as systemic agents or as preventive sprays, the infection of the plants by viruses can be prevented.

(vi) Some of the antibiotics like Terramycin are reported to induce growth in plants and animals. Such antibiotics can be made use of in inducing more vigour in plants to withstand or escape the disease.

Discussion: Thus there is sufficient evidence to show that antibiotics can be widely used in plant disease control. There seems to be however, some shortcomings in putting them into practical use: (a) Some of the antibiotics are reported to be toxic to plants and in some cases they are known to affect the germinability of seeds, (b) most of the antibiotics lose their activity when added to the soil and in other cases they are thermolabile thus making it difficult to use them in agriculture, (*c*) in the case of the antibiotics which act systemically in plants, there is evidence of their activity being reduced or lost after a short period which creates additional trouble in putting them into use.

These shortcomings do not detract from the potentiality of these agents for controlling plant diseases. If anything, similar toxicity and other defects observed in putting them into use in human beings have led in the past to more intensive searches for better antibiotics. Besides these, the high cost of antibiotics makes one feel that it is impossible to use them in agriculture. It has been pointed out that the cost of penicillin, which was so high a few years back, has been brought down to such a low level that at present it costs less than that of the container in which it is packed. So it is hoped that with the quick advancement of science and our knowledge in antibiotics, these defects will be easily overcome and it won't be long before these substances come into extensive use in controlling plant diseases.

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Nitrogen in Paddy Soils

by

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Green manures are perhaps the most self-supporting manures in the tropics and are often claimed to be quite as effecient as Ammonium sulphate in rice production. This is of course, not surprising, seeing that they contain nearly 3–4% of nitrogen on dry weight basis, and a carbon/nitrogen ratio of about 10.

The leafy portion in green manures is naturally richer in nitrogen content than the stems and the decomposition may be noted in two stages, with the leaves figuring in the first stage and stems in the second. Thus green manures serve as a mixture of a quickly efficacious, concentrated nitrogenous fertiliser similar to ammonium sulphate and a more slowly-acting manure similar to compost or cattle manure.

The practice of green manuring is common both in garden lands and in wetlands, but in the former certain precautions are necessary, because with the large quantities of readily decomposed carbohydrate material, there is a possibility of the soil nitrogen getting impoverished. That is why in tea and coffee plantations, green manure applications are always accompanied by liberal doses of amonium-sulphate.

In wetlands, the conditions are different. Though green-manuring is well-known as a very beneficial practice in rice culture, how exactly this beneficial response is brought about is still not settled. If a cross section of paddy field soil is taken it will be seen that only the top half to one inch layer is under aerobic condition and all the lower portion is under anaerobic conditions. The question therefore arises as to the nature of the decomposition of the proteins in the green manures applied. From their classical experiments in 1913 to 1916 in the early days of the Agricultural Department, Harrison and Subramania Ayyar were led to conclude that green manures had little or direct manurial value; and as the rice crop depended primarily on the nitrogen for its growth, green manures were useful only in an indirect manner, by helping to improve the soil aeration.

Joachim and Kandiah working in Ceylon, obtained supporting evidence for this indirect effect, but they found that there was

also a direct effect, by minimising loss of soil nitrogen and improving plant growth thereby.

This problem has also attracted the attention of Japanese workers; but they held the view that nitrogen fixation by blue-green algae was an important factor in flooded rice fields. In fact some even claimed that one of the causes of the relatively high level of fertility of Japanese paddy fields, was attributable to nitrogen fixation by blue-green algae.

Here again, though the fact was well recognised, the actual mechanism involved is still a matter of discussion. Thus P. K. De in Bengal claimed to have proved that the algae themselves are responsible for nitrogen fixation while other workers (Choudhuri, 1940) hold that this function is attributable not to the algae. This divergence of views is unfortunately not an easily resolvable one, on account of the practical difficulty in isolating pure cultures of uncontaminated blue green algae, as they are usually covered with a gelatinous sheath wherein bacteria like *Azotobacter* can survive. The task of separating the bacteria from the sheaths is a difficult one.

Japanese workers have on the other hand, attempted to isolate algal cultures with high nitrogen-fixing ability and studied the inter-relations between the degree of nitrogen fixation by algae to other environmental factors like fertilising. In 1941 Watanabe collected over 600 soils from tropical paddy fields and from them isolated ten species of blue-green algae. Out of these ten, three species were claimed to have a high power of fixing atmospheric nitrogen, viz. *Tolypothrix tenuis* from Borneo, *Calothrix orevissima* from Parao and *Arabaenopsis* sp. from Sumatra.

Attempts have also been made in Japan (Konishi, 1951) to see the effect of artificial inoculation of Japanese rice fields by tropical blue green algae. A significant effect was perceptible after inoculation, in plots which had also been limed, but not otherwise, indicating that the soil reaction (pH. value) played a decisive role in determining the degree of algal effect. Whether the practice would prove to be an economic proposition has not, however been determined so far.

Denitrification under water-logged conditions: The surface water of a flooded rice field gets sufficient oxygen from the atmosphere and also from the photosynthetic action of hydrophytes like blue-green algae. This oxygen has an influence only on the uppermost

layer, extending to not more than one inch at the most. Below this "aerobic" or "oxidised" layer there is a much larger "reduced" layer where micro-organisms live under anaerobic conditions. This reduced layer constitutes the main portion of the paddy soil, and under the anaerobic conditions existing here, the question is still open whether the paddy plant utilises nitrogen in the form of ammonia. Experiments in Japan and also at Cuttack, with placement of fertilisers like ammonium sulphate have shown that placement arrests the oxidation of ammonia to the easily leachable from of nitric-nitrogen. If the paddy plant is capable of utilising ammonia, there must be some form of ammoniacal nitrogen detectable under paddy field conditions. So far experiments by various workers and in particular the latest investigations carried out at Coimbatore have indicated only the presence of soluble proteins. So that the questions as to the form in which the paddy plant absobs and utilises its nitrogen requirement, still remains unsolved, awaiting further investigation for its elucidation.

CROP AND TRADE REPORTS

Crop Statistics—1953—'54—Madras State. Groundnut Final Forecast: The area sown in the Madras State upto 25th December 1953 is estimated at 1,872,000 acres evealing an increase of 1·1% over last year and 2·2% over the average area calculated for the five years ending with 1951—'52. The increase in area this year is due mainly to timely rains at the time of sowings. The yield per acre is expected to be normal in the districts of Salem, Tiruchirapalli and Tanjore and slightly below the normal in all the other districts of the State. The seasonal factor for the State as a whole works out to 96 percent of the normal as against 75 percent of the normal estimated for the corresponding period of the previous year. On this basis, the total yield is expected to be 902,600 tons of unshelled nuts representing an increase of 30·5%. The average wholesale price (machine shelled) per maund of 82–2/7 lb. or 3,200 tolas as reported from important market centres on 9th January 1954 reveal an increase of 22·2 percent in Erode, 10·8 percent in Vellore, 7·6% in Salem, 7·9% in Cuddalore and 4·4% in Coimbatore.

Gingelly—Third Forecast: The area sown in the Madras State upto 25th December 1953 is estimated at 3,46,000 acres an increase of 10·8% percent over the five year average. The main crop has been harvested. The yield per acre is expected to be normal in Salem district and slightly below the normal in all the other districts of the State. The seasonal factor for the State as a whole works out to 95 percent of the normal as against 79 percent of the normal in the corresponding period of last year. On this basis, the total yield is estimated at 43,200 tons revealing an increase of 33·7% over last year and 31·3% over the five years average. The average wholesale price of gingelly seed per maund of 82-2/7 lb. as reported from important market centres on 9th January 1954 reveals a decrease of 17·2 percent in Tiruchirapalli and 15·2 percent in Tirunelveli. (Director of Statistics, Madras).

EXTRACTS AND GLEANINGS

The Indian Bristle Trade: It may not be known to all that India is an important source of pig bristles for the brush manufacturing industry. The main raw material in the making of brushes comes from the bristles obtained from the back of the neck on pigs. In Great Britain though pigs are reared in large numbers; they are not useful for obtaining the bristles required by the brush ware industry, because long and intensive breeding for early maturity and pork quality has evolved an animal with a fine, short and scanty coat of hair. Hence the chief bristle-producing countries were Russia and Poland in Europe and China and India on the Asian continent, up to the first quarter of the present century. Since then supplies have dwindled from Poland and Russia while China has advanced to the forefront as the principal supplier. India continues to be the second best country for suppling pig bristles.

The total pig population of India is estimated at about 3·71 lakhs, in the Uttar Pradesh, Madras and Bihar as the leading States in this respect. The seasonal output of bristles is valued at over a crore of rupees; the quantity exported per year varying from 3,600 to 4,900 cwts. Bulk for bulk it is a fairly expensive commodity the present price being about Rs. 10/-.per lb. after being stabilised by the Government of India, the peak being Rs. 25/- per lb. in 1951 due to the short supply from China owing to the Korean War and stockpiling.

At the present moment, China seems to be the only country which is a serious rival to India's bristle trade. Since quality is the keystone of every export structure, efforts should be concentrated to standardise and maintain rigidly definite quality grades in order to retain the goodwill of buyers abroad. Of late there have been complaints (as in many other items in India's export-trade) regarding the wide range of variations in quality and high percentage of adulteration in Indian bristle consignments. Since few commodities offer greater scope for deception the Government of India have passed the Bristles Grading and Marketing Act in 1950 to safeguard the export trade in bristles but sufficient steps have not been taken so far to ensure a thorough check on the processes bristles have to be put through, from the time of its picking till its shipping such as disinfecting, boiling, straightening, grading, dressing and packing. The colours that are preferred are white or black, grey being the least preferred. In India, however, grey is the predominent colour in most cases. The length varies from 2 inches (known as shorts) to 7 inches or longer, the latter naturally fetch a much better price.

Provided India is able to maintain adequate quality control and standardisation of grades, there is no reason why we should lose our present favourable position in the international bristle market even after the United States of America withdraws its import restrictions on Chinese bristles. (T. R. N.)

* * * *

Phosphate relationships of Soil and Plant — III. Forms of P., in the Brannalt limed and unlimed podzol series — By Sante Maltron, Emlyn, G. Williams and Eugen Barkoff — pp. 107–120 (Annals of the Royal Agricultural College of Sweden, Vol. 17–Uppsala 1950.)

The following forms of P., have been studied in the Brannalt profile series, including the excessively limed soil in the field and the unlimed virgin podzol under a stone fence:— (1) Acid oxalate — soluble P., (2) 0·2 N. H_2SO_4 — soluble· (3) Organic. (4) 2·5% acetic acid soluble. P. (5) Neutral 0·5 N. NH_4F soluble P. (6) Lactate-soluuble P.

The fluoride liberated, acid soluble, beta-humus has also been determined and found to be formed in considerable quantities in the limed profiles as a product of autoxidation. The beta-humus precipitates in the upper beta horizon where it displaces the phosphate which is pushed deeper down into the lower beta horizon.

* * * *

Phosphate relationships of Soil and Plant - IV Forms of P. in the Hydrologic soil series of the Dala brown earth and the unden Podzol — By Santi Maltron, Eugen Barboff and Emlyn G. Williams. ibid. 1950 pp. 120—129.

This is a report on the distribution in these profile series of some of the forms of P., (as the sulphuric acid-soluble P., organic P. etc.) discussed in the proceeding paper on the Brannault series.

Phosphate relationships of Soil and Plant — V. Forms of P., in the Lanna soil By Sante Maltron, Emlyn, G. Williams, Elisabeth Koutler — Andersson and Eugen Barkoff — pp. 130–140; ibid 1950.

The parent material of the Lanna soil possesses a high base status and is rich in P., most of which is Ca-bound. Due to impeded drainage the lower subsoil is only slightly leached and has an alkaline reaction and a high P., content.

The top soil and the upper subsoil is acid and is low in inorganic P., all of which is sesquioxide-bound. The organic P., is relatively high in the top soil.

Liming the soil has apparently stimulated the decomposition of the organic P., compounds. Compared to the unlimed plots the limed plots possess a greater content of all forms of inorganic P.

* * * *

Phosphate relationships of Soil and Plant — VI. The salt effect on phosphate solubility in Pedalfer soils — Sante Maltson, Egil Abosaker, Elisabeth Koutler — Andersson, Eugen Barkoff and Karel Vahtras — pp. 141–160; ibid 1950.

The effect of neutral salts on solubility in pedalfer soils is of two kinds. 1. Displacement of the phosphate ions by the anions of the salt resulting in a greater solubility. This reaction depends on the basoid content and dominates at low pH. 2. Suppression of the Donnan distribution of the ions, resulting in a greater adsorption. This reaction depends on the acidoid content and dominates at higher pH. The point of zero salt effect depends on the acidoid basoid ratio and on the valence of the anions of the salt.

* * * *

Phosphate relationship of Soil and Plant VII. Forms of P., in the Marste hydrologic clay series — By Sante Mattson, Erik Eriksson, Elisabeth Koutler — Anderson, Eugen Barkoff, Sten Stahlberg and Karel Vahtrass; pp. 222-246 ibid 1950.

The paper is a report on the pH and the distribution of Cl, SO_4 $CaCO_3$ and different forms of PO_4 in the Marite hydrologic clay profile series. The profiles cover a stretch of nearly 600 meters and a difference in elevation of 3·6 meters. The lower or "wet end" profile extends through a layer of 10 meters of post glacial, varved clay. The intermediate profile cover both forms of clay. The top soil of the dry end contains $CaCO_3$ and is rich in PO_4 mostly soluble in weak acids. The top soil of wet end is acid and poor in PO4 mostly insoluble in weak acids. (I. R. & A. M. K.)

Weather Review — For the month of February, 1954.

RAINFALL DATA (IN INCHES)

Division	Station	Total for the month	Departure from normal	Total since 1st January	Division	Station	Total for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	0·0	— 0·4	2·7	South	Madurai	0·1	— 0·4	3·5
						Pamban	0·0	— 0·9	2·7
						Koilpatti*	0·0	— 1·3	4·4
	Tirurkuppam*	0·0	— 0·5	3·1		Palayamcottai	0·0	— 1·2	3·3
	Vellore	0·0	— 0·3	2·3					
	Gudiyatham*	0·0	— 0·2	2·0		Ambasamudram*	1 0	— 0·8	8·7
East Coast	Palur*	0·6	+ 0·2	3·3	West Coast	Trivandrum	1·6	+ 0·8	3·7
	Tindivanam*	0·0	— 0·3	3·0		Fort Cochin	0·0	— 0·8	1·5
	Cuddalore	0·9	— 0·0	6·1		Kozhikode	0·0	— 0·7	0·2
						Pattambi*	0·0	— 0·8	0·0
	Nagapattinam	0·1	— 0·7	4·0		Taliparamba*	0·0	— 0·1	0·5
	Aduturai*	£	— 0·8	2·7		Wynaad*	..	..	..
	Pattukottai*	0·1	— 0·8	4·3		Nileshwar*	0·0	£	0·3
						Pilicode*	0·0	— 0·1	0·2
Central	Salem	0·0	— 0·3	1·0		Mangalore	0·0	— 0·2	0·3
						Kankanady*	0·0	— 0·1	0·4
	Coimbatore (A. M. O.)*	£	— 0·2	3·4					
	Coimbatore	0·0	— 0·4	3·5	Hills	Kodaikanal	0·0	— 1·5	6·8
						Coonoor*	1·8	— 1·3	10·2
	Tiruchirappalli	0·0	— 0·3	1·8		Ootacamund*	0·5	— £	2·4
						Nanjanad*	0·3	— 0·3	2·1

Note:—1. * Meteorological Stations of the Madras Agric. Dept. 2. £ Rain-fall 1 to 4 cents.

A low pressure wave was moving westwards across the extreme South-west Bay of Bengal on 1 – 2 – 1954, which moved over the Ceylon—Comorin area on the next day and passed away west-wards across the Maldives area on the third day. This was quickly followed by another low pressure wave on 4 – 2 – 1954 on the same track. After a lull for six days another low pressure wave moved westwards across Ceylon—Comorin area on 12 – 2 – 1954. On 20 – 2 – 1954 a low pressure wave moved westwards across the same area as the previous one and passed away across the Maldives on the very next day. A low pressure wave was moving westwards across the South-west Bay of Bengal on 23 – 2 – 1954 but this became unimportant in two days. On 26 – 2 – 1954 also a low pressure wave moved westwards across the Comorin area closely followed by another low pressure wave on 28 – 2 – 1954.

A series of eight Western Disturbances, with their associated Secondaries passed over the North-west and North India during this month. Generally dry weather prevailed over the Madras State, except for scattered showers in coastal Tamil Nad on 1 – 2 – 1954 and in interior Tamil Nad on 27 – 2 – 1954. Day temperatures were high during the second half of the month. Palghat recorded the highest maximum temperature of 102°F., on 14 – 2 – 1954. The only note-worthy rainfall during the month was 1·54″ recorded on 27 – 2 – 1954 at Sim's Park, Coonoor. Details of the zonal rainfall in inches for the month are furnished hereunder.

S. No.	Name of zone		Average for the month	Departure from normal	Remarks
1.	North	..	0·00	— 0·35	Below normal
2.	East Coast	..	0·48	— 0·40	,,
3.	Central	..	0·01	— 0·30	,,
4.	South	..	0·22	— 0·92	Far below normal
5.	West Coast	..	0·16	— 0·22	Below normal
6.	Hills	..	0·65	— 0·78	,,

Agricultural Meteorology Section
Lawley Road P. O.,
Coimbatore, 13—3—1954.

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service — Postings and Transfers

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